

CHAPTER 6

FIRE PROTECTION SYSTEMS

6-1. General fire protection system design

All new designs, modifications to existing facilities, and retrofits that have a possible effect on fire safety shall be reviewed by a qualified fire protection engineer. All areas, except as otherwise noted, shall be protected by fire suppression systems with each functional area having a separate zone valve. The sprinkler system(s) shall be hydraulically designed. All areas shall be provided with detection system(s) appropriate to the hazard. All areas shall be provided with manual fire extinguishers appropriate for the hazard. Fire protection systems for Department of Defense (DOD) facilities shall comply with military handbook MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design, and Construction and NFPA codes, except as modified herein. If the using government agency regulations are more stringent than the NFPA codes, then in all cases the most stringent requirement shall be met.

6-2. Authority having jurisdiction (AHJ)

The term "AHJ" shall mean the component office of responsibility. The AHJ shall have final approval of drawings and interpretation of code relating to the fire protection systems.

6-3. Services and qualifications of fire protection engineer

Fire protection drawings, specifications, and calculations shall be prepared under the supervision of, and be approved by, a licensed and/or degreed fire protection engineer.

6-4. Specifications

The design agency shall prepare and/or utilize the following specifications when installing or modifying fire protection systems.

- a. All installations of new sprinkler systems and all modifications to existing systems shall be accomplished after the preparation of a performance specification. The performance specification shall be prepared to secure the services of a fire protection engineer and a recognized sprinkler seller licensed under the state in which the work is to be performed for the design and installation of the system(s).
- b. Guide specifications which are issued and approved by the DOD components shall be used in the procurement of sprinkler systems for new facilities and processes, as well as modernization, renovation, and repair work on existing facilities.

6-5. General design requirements

Total volume, pressure, and design flow rate of water necessary to provide fire protection for facilities shall be determined by the methods described in the following paragraphs. All sprinkler or other automatic fire suppression system components shall be Underwriters Laboratories (UL) or Factory Mutual approved for the particular application chosen. The type of fire suppression system and agent to be used for the individual facility areas shall be based on guidance in MIL-HDBK-1008 and NFPA 10 and subject to the approval of the site AJH.

a. NFPA 13, Installation of Sprinkler Systems, and MIL-HDBK-1008C shall be used to determine the Occupancy Hazard Classification. Light hazard occupancy rules are prohibited.

b. The design of sprinkler systems shall be in accordance with the requirements of the NFPA 13, 14, Installation of Standpipe and Hose Systems, and 15 (latest revisions), Water Spray Fixed Systems for Fire Protection, and their appendices. All sprinkler systems shall comply with NFPA 13. All supports and hangers shall be in accordance with NFPA 13 and 14. The design of fire protection systems to withstand seismic events shall be in accordance with the criteria developed by the NFPA. Installation of standpipe systems shall comply with NFPA 14. Portable fire extinguishers shall comply with NFPA 10, Portable Fire Extinguishers.

c. New sprinkler systems shall be designed using hydraulic calculations. Calculations shall follow the format of NFPA 13. Additions to existing pipe schedule systems may be designed using the pipe schedule method. NFPA 13 shall be used to determine water supply requirements for hose streams (gpm) and duration (minutes). Density curves presented in NFPA 13 shall be used for calculating sprinkler demand for hydraulically designed systems. For hazard classifications not covered in NFPA 13 and certain other special occupancies or hazards, design density and area of coverage shall be as specified by other more appropriate standards referenced in NFPA 13 or within MIL-HDBK-1008C. For ordinary hazard occupancies and above, hose stream requirements shall be a minimum of 500 gpm regardless of the hose stream demands listed in the above references unless otherwise specified. The maximum design velocity shall be 20 fps. Determination of adequacy of water supply shall be made on the basis of actual flow test data gathered using the methods in NFPA 13.

d. Materials for the construction of sprinkler systems shall be fully specified in the design package or performance specifications. All materials shall be listed in the UL Fire Protection Equipment Directory or in the Factory Mutual Approval Guide. Approval of materials will be based on the manufacturer's published ratings.

e. Automatic sprinkler system and fire protection extinguishing system designs shall be produced on separate drawings and shall never be incorporated in drawings showing other piping systems. Separate drawings shall be produced for each building.

(1) For work to be done by a sprinkler contractor, complete shop drawings must be submitted for approval before proceeding with any work. The drawings shall be to a convenient scale, clearly indicating the essential details including all specialties, concealed spaces, and ventilators. In general the shop drawings shall include a layout of the sprinkler or hose systems, or a combination of both systems, in the designated areas. The fabrication number of all pipelines, locations, test pipe, drain connections, valves, hangers, and other pertinent features shall be shown on the layout. The size, number, type, and temperature ratings of the sprinkler heads shall also be shown on each layout.

(2) As-built drawings of all sprinkler construction shall be provided.

f. Sprinkler systems shall normally be wet pipe in accordance with NFPA 13 for the appropriate occupancy hazard classification for the facility. Hydraulic designs shall be provided for all systems.

g. In unheated areas or other areas subject to freezing temperatures, dry pipe systems shall be provided. Because of the time delays associated with release of the air in the system, water demands for dry pipe systems shall be computed over areas 30 percent greater than for comparable wet pipe systems. Where the unheated area is small it may be cost effective to install an antifreeze system or small dry pipe system supplied from the wet pipe system in the main heated area.

h. For extra hazard areas and specific hard-to-extinguish fuels such as explosives and pyrophoric (spontaneously igniting) metals, a deluge system with open sprinkler heads may be used to wet down the entire protected area simultaneously. Deluge systems shall comply with NFPA 13. If quick response is required, indoor deluge system piping may be primed with water and in unheated areas with antifreeze solution. The nozzles must be provided with blow-off caps for water-filled deluge systems.

i. Sprinkler piping shall be arranged to drain through the main drain valve whenever practical. All trapped sections of pipe, except those supplying a single sprinkler, shall be provided with an auxiliary drain valve complete with nipple and cap or brass plug.

j. The following sprinkler system test connections shall be provided.

(1) A test connection not less than 1 inch in diameter, terminating in a smooth bore corrosion-resistant orifice, giving a flow equivalent to one sprinkler of a type having the smallest orifice installed on the particular system, shall be provided to test each waterflow alarm device for each wet pipe system.

(2) In a dry pipe system a test connection not less than 1 inch in diameter, terminating in a smooth bore corrosion-resistant orifice, to provide a flow equivalent to one sprinkler of a type installed on the particular system, shall be installed on the end of the most distant sprinkler pipe in the upper story. It shall be equipped with a readily accessible 1-inch shutoff valve and plug, at least one of which shall be brass. In lieu of a plug, a nipple and cap shall be acceptable.

k. Sprinkler protection shall be provided at the top and under the bottom landing of each stairway.

l. A gate valve, outside screw-and-yoke type, shall be provided on the supply side of the main sprinkler valve inside the facilities. The gate valve shall be provided in addition to the post indicator valve located in the feed main outside the building.

m. Penetrations through concrete floors and walls shall be made with pipe sleeves. All penetrations shall contain firestopping with a fire rating equal to that of the area being penetrated. Shielded penetrations shall be required for fire protection piping that penetrates shielded areas as addressed in Military Handbook MIL-HDBK-419A, Grounding, Bonding, and Shielding for Electronic Equipment and Facilities.

n. Sprinkler piping shall be labeled. All sprinkler pipes shall be painted red (NFPA 13).

6-6. Special protection systems

Special protection systems may be used to extinguish or control fire in easily ignited, fast-burning substances such as flammable liquids, some gases, and chemicals. They shall also be used to protect ordinary combustibles in certain high-value occupancies especially susceptible to damage. Special protection systems supplement automatic sprinklers as described by NFPA and shall not be used to substitute for them except where water is not available for sprinkler protection. The added expense of the supplementary system shall be supported by documented justification. The selection of a particular special suppression system shall be based on the effectiveness of that system or agent for the type of hazard, and the damage likely to be caused by the extinguishing agent, including cleanup and downtime.

6-7. Water supply pressure requirements

Pressure required for sprinklered facilities shall be the pressure required to meet the total demand and shall be determined by hydraulic calculations. The total demand is the required sum of the domestic demand, sprinkler demand, and hose stream demand.

6-8. Quantities of water required

Requirements for fire protection water storage are based on the assumption that there will be only one fire at a time. The quantity of water required is equal to the product of the fire protection water demand and the required duration. This quantity represents fire protection requirements only, and shall be available at all times. Water supply for domestic, industrial, and other demands shall be added to these requirements to determine the total amount of water that is necessary at a facility. No separate water storage facility is required if the public water system supplying a facility is reliable, provides a minimum of two connections (each providing at least 50 percent of the required capacity), has adequate capacity and pressure to meet requirements, and continuous reserve storage.

- a. The total stored supply for fire protection purposes shall be sufficient to meet the maximum required fire flow demand for the duration specified.
- b. In computing the fire protection storage requirement, a reduction in storage capacity is acceptable if an adequate replenishment source is available. Factors that must be evaluated include the reliability of the makeup facility, its sustained flow capacity, its method of operation (automatic or manual), and flow limitations imposed by the capacity of treatment operations.
- c. The water storage shall be self-replenishing. It shall reach required volume during normal consumption within 48 hours, and within 24 hours curtailing normal consumption.
- d. Water demands for sprinklered facilities shall be in accordance with military handbook MIL-HDBK-1008C, table 3, "Water demands for sprinklered facilities," based on the required occupancy classification.

6-9. Sources of water supply

Primary and secondary water supplies shall be obtained from the sources described below.

- a. Primary water supplies shall consist of one or a combination of the following.
 - (1) Two connections to a public water system (one connection is ample for a small activity or facility)
 - (2) Elevated tanks or reservoirs
 - (3) Multiple pumps with adequate suction supply
- b. Where public water supply is inadequate or unreliable, a secondary supply is required. Secondary supply shall be by gravity tank, pressure tank, booster pumps taking suction from adequate capacity main(s), or fire pumps taking suction from adequate source(s).

6-10. Water distribution and storage

Fire water distribution and storage systems will be based on the following guidance.

- a. Wherever practical, dedicated fire water storage and distribution systems shall be used. If a dedicated fire water supply system cannot be provided, the fire protection water supply shall assure availability regardless of simultaneous process and domestic water usage.

- b. Where automatic sprinkler systems or standpipes are fed from a potable water system, approved check valves shall be installed in sprinkler lead-ins to preclude the introduction of pollutants from systems or recirculation of stagnant water that would contaminate the domestic water system.
- c. Underground fire water mains or combined fire and domestic water mains, including valves, hydrants, and fittings, shall be installed, flushed, sterilized, and tested in accordance with NFPA 24, Private Fire Service Mains. Water storage tanks shall comply with NFPA 22, Water Tanks for Private Fire Protection. Fire pumps shall comply with NFPA 20, Standard for the Installation of Stationary Fire Pumps for Fire Protection. Water storage shall be sufficient to meet the density, pressure, and duration requirements of NFPA 13.
- d. Whenever feasible, all water distribution systems shall be of the looped grid type providing two-way flow with sectional valving arranged to provide alternate water flow paths to any point in the system. Dead-end mains shall be avoided. Fire mains (except those supplying a single hydrant or extensions of existing smaller mains) shall be at least eight inches. Mains shall be sized to supply the largest fire demand plus the largest domestic and process demand with consideration for residual sprinkler system pressure requirements.
- e. Sprinkler supply lead-ins should be at least six inches, except lead-ins of four inches may be used for very small sprinkler systems when substantiated by hydraulic calculations. In no case shall the lead-in be smaller than the sprinkler riser.
- f. Where combined fire and domestic process water systems are used, the supplies to each building shall be arranged and valved so that the domestic and process systems can be shut down without shutting off the fire system supply.
- g. Sprinkler risers should be located at an exterior wall of a dedicated sprinkler riser room. Sprinkler supply lead-ins should run under buildings the minimum distance possible.
- h. Outside control valves that can be locked open shall be provided on each supply lead-in located if possible a minimum distance of 40 feet from the building. Post indicator valves (PIVs) should be used where possible. If site conditions preclude the use of PIVs, such as where they would be subject to mechanical damage and cannot be properly guarded, outside screw and yoke valves in pits may be used.
- i. Key-operated buried valves shall not be used for sprinkler control valves. In no case shall there be more than one valve controlling a sprinkler supply lead-in.
- j. All lead-ins shall be connected with the sprinkler system at the base of the riser. Alarm valves shall be located as close as practical to the building entry point. Hydrants shall be provided so that hose lays from hydrants to all exterior portions of a protected building are no more than 300 feet. Hydrants shall not be closer to buildings than 50 feet. For new construction, at least one hydrant shall be located within 150 feet of fire department connections. Hydrants shall comply with requirements of MIL-HDBK-1008C.
- k. Design water mains supplying fire protection systems and fire hydrants to meet further requirements of NFPA 24.

6-11. Fire pumps

Pumps shall be provided to boost pressure for municipal water systems if needed, and to provide pressure to the sprinkler system when supplied from a secondary water source. Fire pumps, drivers, and controllers shall meet the requirements of NFPA 20.

- a. A fire pump may be either a horizontal or vertical shaft centrifugal pump or a vertical shaft turbine pump, whichever is most economical and appropriate for the intended use. A horizontal centrifugal pump in either the horizontal or vertical position shall not be used where suction lift is required. A vertical shaft turbine pump shall be used for suction lift.
- b. Fire pumps shall be arranged to start automatically except that they shall be arranged for manual starting when other available water supply sources are capable of providing demands for automatic sprinkler systems simultaneously with domestic and industrial demands. The fire pump shall be capable of being remotely operated from the CR.
- c. Fire pumps shall be fed from a reliable single power source or from two independent sources in accordance with NFPA 20 during normal operations. Upon a loss of the commercial electrical power, fire pumps shall be fed from the emergency generator circuit. Spark ignited internal combustion engines shall not be used to drive fire pumps. Diesel engine driven fire pumps in accordance with NFPA 20 will be acceptable.
- d. The fire pumps shall be provided with an automatic operating water level controller. The controller shall operate using water pressure control or fire protection equipment control.

6-12. Mission areas

These areas include major automated data processing (ADP) areas, communications centers, command and control system areas, computer areas, and other mission critical areas. Unless otherwise specified, MIL-HDBK-1008C and NFPA 75, Electronic Computer/Data Processing Equipment, shall be followed in the design and construction of computer and electronics mission areas. Computer areas shall be separated from other occupancies within the building by fire-resistant rated construction.

- a. An automatic sprinkler system shall be provided to protect mission areas. Sprinkler systems protecting mission areas shall be valved separately from other sprinkler systems. Halon[®] 1301 systems shall not be used. It is assumed that strategically important spaces are staffed 24 hours a day for 365 days a year. Therefore, adequate extinguishers appropriate to the hazard should be a sufficient replacement for the total flooding system. However, extinguisher protection cannot be considered as a substitute for an automatic sprinkler system. Mission-essential electronic equipment shall be protected with wet pipe sprinkler systems. Preaction systems shall not be used.
- b. Smoke detectors shall be provided for all electronic equipment areas. Automatic detection systems shall be installed at the ceiling level and below the raised floor spaces. Automatic detection should also be provided above ceilings and in attics where equipment or wiring is installed in order to alert facility personnel to the presence of smoke and/or fire before it enters the electronic equipment areas. Smoke detectors shall be the photoelectric type. Ionization detectors may be used if they are cross-zoned with photoelectric detectors and are rated for high airflow. In cable trays, line-type heat detectors shall be used. The detection system shall be cross-zoned. Automatic equipment power shutdown, activated by sprinkler water flow or two smoke detectors, shall be provided via the fire alarm control panel. Automatic shutdown of the computer room air-conditioning units by the fire alarm control panel shall also be provided.
- c. Under floor spaces of less than 5000 cubic feet in volume do not require a fire extinguishing system. Under floor spaces shall not be subdivided to reduce total volume. Where the air space below a raised floor or above a suspended ceiling is used to recirculate computer room/computer area

environmental air, the wiring shall conform to Article 645 of NFPA 70, NEC. A structural floor where a computer system is located, or that supports a raised floor installation, shall incorporate provisions for drainage from domestic water leakage, sprinkler operation, coolant leakage, or fire fighting operations. Structural supporting members and decking for raised floors shall be noncombustible. Access sections or panels shall be provided in raised floors so that all the space beneath is accessible.

d. Listed portable extinguishers suitable for use on electronic equipment shall be provided. Listed extinguishers with a minimum rating of 2-A shall be provided for use on fires in ordinary combustible materials, such as paper and plastics. A sign shall be located adjacent to each portable extinguisher and shall plainly indicate the type of fire for which it is intended. Where inside hose is provided, the hose shall be 1-1/2 inch rubber-lined hose with shutoff and combination solid-stream and water-spray nozzles. It shall be installed and maintained in accordance with NFPA 14.

e. A means shall be provided to disconnect power to all electronic equipment in the missions areas. There shall also be a similar means to disconnect the power to all dedicated HVAC systems serving the areas and to cause all required fire/smoke dampers to close. The control for these disconnecting means shall be grouped and identified and shall be readily accessible at the principal exit doors. A single means (i.e., a panic button) to control both the electronic equipment and HVAC systems shall be permitted. A similar disconnecting means shall also be required for UPS systems installed within the mission areas. This disconnecting means shall also disconnect the battery from its loads.

6-13. Mission administration

The administrative spaces in the mission area may be connected to the same sprinkler system as the mission spaces. The entire mission administration area shall be protected with an automatic sprinkler system. The requirements of NFPA 101, Life Safety Code, shall be met unless otherwise specified. Specific requirements for mission administration area(s) include the following.

- a. Office and dayroom spaces shall be equipped with smoke detectors.
- b. Range-top cooking surfaces located in common areas (i.e., not in individual units) shall be protected with an approved range-top extinguishing system. Such systems shall be connected to the building fire alarm system to sound a general building fire alarm. A range-top extinguishing system is not required when the building is protected by an approved automatic sprinkler system.
- c. Hard-wired smoke detectors in accordance with NFPA 72, National Fire Alarm Code, shall be provided in sleeping areas. A hard-wired smoke detector shall be provided for each sleeping area or room regardless of occupancy or the presence of other detection or protection systems in the building. When activated, the affected detector shall generate an audible signal in the room. Detectors which use a battery as the primary power source are not permitted. Sleeping areas shall have Class A interior finishes.

6-14. Generator set area

Installation, maintenance, operation, and testing requirements as they pertain to the performance of emergency power supply systems shall comply with NFPA 110, Emergency and Standby Power Systems. Installation of prime movers and accessories shall comply with NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, except as modified by NFPA 110. In general, electrical installations shall conform to Article 700 of NFPA 70.

- a. Emergency generator sets shall be located in a separate room that is separated from the remainder of the building by fire separations having a minimum 2-hour fire rating. Or, generator sets shall be located in a separate generator building capable of preventing the entrance of snow or rain, resisting maximum wind velocity required by the local building code, and preventing flood damage, sewer water backup, and similar disasters. Consideration shall be given to the location of the emergency generators to minimize the possibility of damage caused by vandalism, sabotage, and other similar occurrences. Generators shall be installed in a location that will permit ready accessibility and adequate working space around the unit.
- b. A separately zoned system shall be provided for each prime mover above the finished floor. The area below the finished floor under each unit, including all sumps, trenches, and drainage pits shall be provided with a separately zoned automatic sprinkler system. Containment barriers shall be installed in sump/trench areas between the generators to prevent an oil fire from spreading the length of the power plant. Electrical equipment shall be protected with hoods or shields of noncombustible materials or housed in National Electrical Manufacturers Association (NEMA) 4X enclosures designed to be wetted without adverse effects.
- c. Each emergency generator shall be provided with approved fire extinguishers of appropriate size, type, and number as specified in NFPA 10.
- d. Emergency generator rooms or separate generator buildings shall be equipped with fire detection systems in accordance with NFPA 72.
- e. Emergency generators shall be adequately protected from damage due to lightning.
- f. Openings in the emergency generator room that open to other sections of the building shall be provided with automatic or self-closing fire doors or dampers to confine a fire to the generator room.

6-15. Switchgear and uninterruptible power supply areas

Installation, maintenance, operation, and testing requirements as they pertain to the performance of the stored emergency power supply systems (i.e., UPS) shall comply with NFPA 111, Stored Electrical Emergency and Standby Power Systems. All areas of the switchgear and UPS areas shall be fire-rated, including all penetrations. These areas shall be protected by photoelectric smoke detectors and an automatic sprinkler system. Total flooding Halon® 1301 systems shall not be used. The consideration of halon substitutes (such as FE-200) shall be subject to the approval of the site AHJ. The UPS shall be permitted to be located in switchgear or other electrical service room, provided that the manufacturer's environmental specification is met. The rooms or buildings housing the UPS shall be located to minimize the possibility of damage from flooding, including flooding resulting from fire fighting, sewer water backup, and similar disasters or occurrences. The UPS shall be installed in a location that allows ready accessibility and adequate working space for the inspection, repair, maintenance, cleaning, or replacement of the unit.

6-16. Battery room

The battery room shall be of fire-rated construction. A fire detection system and an automatic sprinkler system shall be provided. An automatic ventilation system shall be provided that keeps the battery room hydrogen (H₂) concentration below 2.0 percent by volume at all times. The ventilation volume shall be referred to chapter 7, paragraph 7-15, Uninterruptible power system battery room ventilation. A trouble alarm shall be transmitted to the central receiving station if the concentration of H₂ exceeds the control limit. Portable fire extinguishers appropriate to the hazards shall be located in and adjacent to the battery

room. Rooms or buildings housing the stored emergency power supply system (i.e., UPS, central battery system, etc.) shall be located to minimize the possibility of damage from flooding, including flooding resulting from fire fighting, etc.

6-17. Control Room (CR)

The CR shall be provided with photoelectric smoke detectors, a smoke evacuation system, and an automatic sprinkler system. Fire extinguishers appropriate to the hazards shall be located in and adjacent to the CR.

6-18. Data and power cabling areas

The following guidance shall be used to establish fire protection requirements in areas used to route data and power cables.

- a. Power cables installed in the ceiling plenum or below raised floor shall meet the requirements of NFPA 70, except that use of nonmetallic conduit shall not be permitted. Data and other communication cables installed in ceiling spaces and under raised floors shall be plenum rated or installed in conduit in accordance with NFPA 70.
- b. Different classes of cables, such as medium-voltage, low-voltage, and instrument cables shall be installed in cable trays or raceways specifically dedicated to each class. Where cable trays are arranged in tiers, the cables shall, whenever possible, be installed in tiers in order of fault energy, with the highest fault energy cables in the upper trays and instrumentation cables in the lower trays. Detection in the cable trays shall consist of line-type wire heat detectors.

6-19. Fuel storage area

Petroleum fuel facilities shall comply with military handbook, MIL-HDBK-1022, Petroleum Fuel Facilities, NFPA 30, Flammable and Combustible Liquids Code, and NFPA 37.

- a. For aboveground storage tanks provide fire protection water mains, hydrants, valves, pumps, and application devices to permit control of brush and grass fires and cooling of storage tanks in the event of a fire exposure. Provide a minimum of two hydrants. Locate hydrants and valves outside of diked areas. Locate hydrants so that protection exposures can be reached through hose runs not exceeding 300 feet (90 m). Comply with all requirement of MIL-HDBK-1008C for water supply.
- b. Aboveground vertical tanks storing Class II mission critical fuels (i.e., JP-5, JP-8, and diesel fuel used for shipboard fueling) shall be equipped with internal honeycomb floating pans constructed of aluminum. Only aluminum pans providing closed cells and full fuel contact will be permitted in new construction. Foam fire extinguishing systems are not required where internal honeycomb floating pans are installed. Tanks containing other Class II liquids do not require internal honeycomb pans or foam extinguishing systems.
- c. The extent of fire prevention and control provided for the tank storage facility shall be determined by an engineering evaluation of the operation, followed by the application of sound fire protection and process engineering principles.
- d. A venting system appropriate to the class of flammable liquid being stored shall be provided as specified in NFPA 30.

e. If bulk storage is inside the facility, a three-hour separation shall be provided between the storage area and the rest of the facility, and a Class A self-closing fire door shall be installed on each opening into the storage area. Overflow protection shall be provided on storage tanks inside of the facility.

f. The day tanks within the facility shall be protected with the appropriate type of extinguishers. No automatic suppression system is needed near the day tanks since the facility will have an automatic sprinkler system.

6-20. Loading/unloading areas

Unless a loading/unloading area is used for storage of supplies, no special provisions except appropriate fire extinguishers should be provided. If the loading/unloading area is used for a storage area, then the requirements of NFPA 230, Fire Protection of Storage, shall be met.

6-21. Entry control points

The guard house at an entry control point shall have provisions for automatic fire detection. A signal shall be sent to the central alarm receiving station indicating alarm or trouble. Appropriate fire extinguishers shall be provided.

6-22. Transmit/receive stations

All transmit/receive stations and antenna arrays shall have provisions for fire detection. A signal indicating alarm or trouble shall be sent to the central alarm receiving station. Appropriate fire extinguishers shall be provided and located adjacent to the station.

6-23. Transformer vault/room

The design agency shall consider the following criteria when establishing the fire protection requirements for transformer installations.

a. Oil-insulated transformers installed indoors shall be located in fire resistive vaults except for indoor transformer installations exempt by NFPA 70. Fire protection for oil-insulated transformers in fire-resistive vaults shall comply with table 2 of MIL-HDBK-1008C. Requirements apply to single-phase or polyphase lighting or power transformers.

b. Transformers insulated with less flammable liquids (fire point not less than 572°F [300°C]), as defined by ASTM D92, Standards Test Method for Flash and Fire Points by Cleveland Open Cup, shall be permitted to be installed without a vault in buildings of Types I and II construction. This applies to areas in which no combustible materials are stored, where there is a liquid confinement area, and where the installation complies with restrictions provided for in the listing of the liquid. Such indoor installations not meeting the requirements of the liquid listing, or installed in other than Types I or II buildings, or in areas where combustible materials are stored shall either be provided with an automatic fire suppression system and a liquid containment area, or installed in an approved vault. Transformers installed indoors and rated over 35,000 volts shall be installed in a vault.

c. Dry type transformers shall be installed and located in accordance with NFPA 70.

6-24. Generator sump

The area below the finished floor under each generator unit, including all sumps, trenches, and drainage pits shall be provided with a separately zoned automatic sprinkler system.

6-25. Cooling towers

Fire protection for field erected water-cooling towers of combustible construction or those in which the fill is of combustible material shall comply with NFPA 214, Water Cooling Towers.